

ARM[®] Cortex[®] - M
32-bit Microcontroller

NuMicro[®] Family
NuTiny-SDK-M031TC
User Manual

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1 OVERVIEW

NuTiny-SDK-M031TC is the specific development tool for NuMicro® M031 series. User can use NuTiny-SDK-M031TC to develop and verify the application program easily.

NuTiny-SDK-M031TC includes two portions. One is NuTiny-SDK-M031TC and the other is Nu-Link2-Me. NuTiny-SDK-M031TC is the evaluation board and Nu-Link2-Me is its Debug Adaptor. Thus, user does not need other additional ICE or debug equipment.

The Nuvoton® Arm® Cortex®-M0 NuMicro® M031/M032 series MCU features 1.8 ~ 3.6V operating voltage, running up to 48 MHz, and provides a good solution for the applications that need low-voltage interface connection operation. This product can be applied to mobile devices, application processor connected peripheral controllers, IoT sensor devices, motor control, industrial control, and consumer devices.

NuMicro® M031/M032 series provide 16 channels of 12-bit ADC with up to 2Msps high conversion rate and the PWM with 96 MHz high performance interface which sourced from PLL clock for the requirement of precise, high response of voltage or current and mass processing data market.

Besides, NuMicro® M031/M032 series also provide up to 3 sets of UART interface for connecting more extended modules in the application such as networking or sensor modules.

The functions of NuMicro® M032 series are all based on M031 and enhanced with USB 2.0 full-speed device feature to provide more possibilities of USB related application.

In brief, the NuMicro® M031/M032 series support the wide voltage range from 1.8V to 3.6V and temperature ranging from -40°C to 105°C, up to 128 Kbytes of Flash memory, up to 16 Kbytes of SRAM, up to 8 Kbytes of ISP (In-System Programming) as well as ICP (In-Circuit Programming) and IAP (In-Application Programming) in LQFP64, LQFP48, QFN33, TSSOP28 or TSSOP20 packages. It also supports high immunity of 4KV ESD (HBM)/4.4KV EFT. It is also equipped with plenty of peripherals such as Timers, Watchdog Timers, UART, SPI, I²C, USCI, PDMA, EBI, GPIO, up to 12 channels of 16-bit PWM, up to 16 channels of 12-bit ADC, USB device, low voltage reset, brown-out detector, 96-bit UID (Unique Identification), and 128-bit UCID (Unique Customer Identification).

2 NUTINY-SDK-M031TC INTRODUCTION

NuTiny-SDK-M031TC uses the M031TC1AE as the target microcontroller. Figure 2-1 is NuTiny-SDK-M031TC for M031 series, the left portion is called NuTiny-SDK-M031TC and the right portion is Debug Adaptor called Nu-Link2-Me.

NuTiny-SDK-M031TC is similar to other development boards. Users can use it to develop and verify applications to emulate the real behavior. The on board chip covers M031 series features. The NuTiny-SDK-M031TC can be a real system controller to design user's target systems.

Nu-Link2-Me is a Debug Adaptor. The Nu-Link2-Me Debug Adaptor connects your PC's USB port to your target system (via Serial Wired Debug Port) and allows you to program and debug embedded programs on the target hardware. The Nu-Link2-Me also supports VCOM function, which gives users more flexibility when debug. To use Nu-Link2-Me Debug adaptor with IAR or Keil, please refer to "Nuvoton NuMicro® IAR ICE driver user manual" or Nuvoton NuMicro® Keil ICE driver user manual" in detail. These two documents will be stored in the local hard disk when the user installs each driver. To use Nu-Link2-Me VCOM function, please refer to Chapter 5.

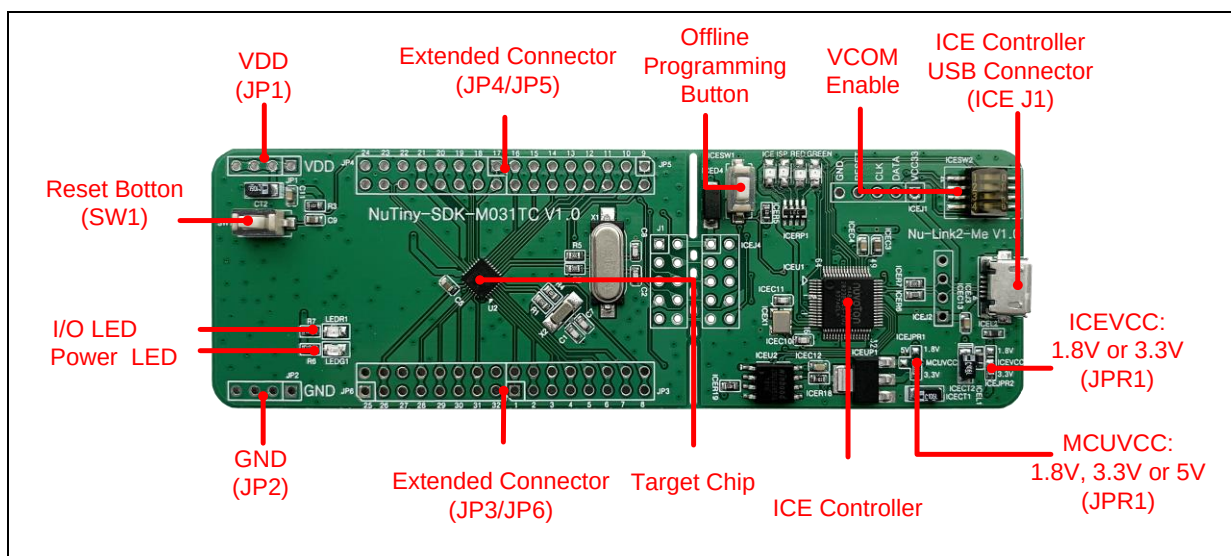


Figure 2-1 NuTiny-SDK-M031TC (PCB Board)

2.1 NuTiny-SDK-M031TC Jumper Description

2.1.1 Power Setting

- ICEJ3: USB port in Nu-Link2-Me
- ICEJPR1: Configures the MCU operating voltage at 1.8V / 3.3V / 5V
- ICEJPR2: Configures the ICE(Nu-Link2-Me) operating voltage at 1.8V / 3.3V
- JP1: VDD Voltage connector in NuTiny-SDK-M031TC

Model	ICEJ3 USB port	ICEJPR1 (MCUVCC)	ICEJPR2 (ICEVCC)	JP1 VDD	MCU Voltage	ICE Chip Voltage
Model 1	Connect to PC	Select 1.8V	Select 1.8V	DC 1.8V output	DC 1.8V	DC 1.8V
Model 2	Connect to PC	Select 3.3V (default)	Select 3.3V (default)	DC 3.3V output	DC 3.3V	DC 3.3V
Model 3	Connect to PC	Select 5V	Select 3.3V (default)	DC 5V output	DC 5V	DC 3.3V
Model 4	X	X	Select 3.3V (default)	DC 1.8 V ~ 3.3 V Input	Voltage by J5 input	DC 3.3V

X: Unused.

Note: Don't configure the MCU operating voltage to 5V because the operating voltage of the M031 series is 1.8V~3.3V.

2.1.2 Debug Connector

- J1: Connector in target board (NuTiny-SD K-M031TC) for connecting with Nuvoton ICE adaptor (Nu-Link2-Me)
- ICEJ4: Connector in ICE adaptor (Nu-Link2-Me) for connecting with a target board (for example NuTiny-SDK-M031TC)

2.1.3 USB Connector

- ICEJ3: Micro USB Connector in Nu-Link2-Me connected to a PC USB port

2.1.4 Extended Connector

- JP3, JP4, JP5, JP6: Show all chip pins in NuTiny-SDK-M031TC

2.1.5 Reset Button

- SW1: Reset button in NuTiny-SDK-M031TC

2.1.6 Power Connector

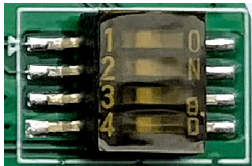
- JP1: VDD connector in NuTiny-SDK-M031TC
- JP2: GND connector in NuTiny-SDK-M031TC

2.1.7 Offline Programming Button

- ICESW1: Offline programming button in NuTiny-SDK-M031TC

2.1.8 VCOM Enable

- ICESW2: VCOM function enable for NuTiny-SDK-M031TC. Switch ICESW2 on before power on to enable VCOM function. ICESW2 connects pin 31(PB.12/RXD) and pin 30(PB.13/TXD) in NuTiny-SDK-M031TC with pin 22(PB.1/TXD) and pin 21(PB.0/RXD) in Nuvoton ICE adaptor (Nu-Link2-Me).

Switch Pin Number	Function Name	UART0 Mode	VCOM Mode	ICESW2
1	ICE_TX/MCU_RX	Off	On	
2	ICE_RX/MCU_TX	Off	On	
3	X	X	X	
4	X	X	X	

X: Unused.

2.2 Pin Assignment for Extended Connector

NuTiny-SDK-M031TC provides M031TC1AE on board and the extended connector (**JP3**, **JP4**, **JP5** and **JP6**) for QFN-33 pin. Table 2-1 is the pin assignment for M031TC1AE.

Pin No	Pin Function
1	PB.5/ADC0_CH5/I2C0_SCL/PWM0_CH0/UART2_TXD/TM0/INT0
2	PB.4/ADC0_CH4/I2C0_SDA/PWM0_CH1/UART2_RXD/TM1/INT1
3	PB.3/ADC0_CH3/I2C1_SCL/UART1_TXD/PWM0_CH2/PWM0_BRAKE0/TM2/INT2
4	PB.2/ADC0_CH2/I2C1_SDA/UART1_RXD/PWM0_CH3/TM3/INT3
5	PB.1/ADC0_CH1/UART2_TXD/I2C1_SCL/PWM0_CH4/PWM0_BRAKE0
6	PB.0/ADC0_CH0/UART2_RXD/SPI0_I2SMCLK/I2C1_SDA/PWM0_CH5/PWM0_BRAKE1
7	PF.5/UART2_RXD/UART2_nCTS/PWM0_CH0/X32_IN/ADC0_ST
8	PF.4/UART2_TXD/UART2_nRTS/PWM0_CH1/X32_OUT
9	PF.3/UART0_TXD/I2C0_SCL/XT1_IN
10	PF.2/UART0_RXD/I2C0_SDA/XT1_OUT
11	PA.3/SPI0_SS/UART1_TXD/I2C1_SCL/PWM0_CH2/CLKO
12	PA.2/SPI0_CLK/UART1_RXD/I2C1_SDA/PWM0_CH3
13	PA.1/SPI0_MISO/UART0_TXD/UART1_nCTS/PWM0_CH4
14	PA.0/SPI0_MOSI/UART0_RXD/UART1_nRTS/PWM0_CH5
15	PF.15/PWM0_BRAKE0/PWM0_CH1/TM2/CLKO/INT4
16	nRESET
17	PF.0/UART1_TXD/I2C1_SCL/UART0_TXD/ICE_DAT
18	PF.1/UART1_RXD/I2C1_SDA/UART0_RXD/ICE_CLK
19	PC.1/UART2_TXD/I2C0_SCL
20	PC.0/UART2_RXD/I2C0_SDA
21	PA.12/I2C1_SCL
22	PA.13/I2C1_SDA
23	PA.14/UART0_TXD
24	PA.15/UART0_RXD
25	VSS
26	LDO_CAP
27	VDD
28	PB.15/ADC0_CH15/SPI0_SS/UART0_nCTS/TM0_EXT/PWM0_BRAKE1
29	PB.14/ADC0_CH14/SPI0_CLK/UART0_nRTS/TM1_EXT/CLKO

30	PB.13/ADC0_CH13/SPI0_MISO/UART0_TXD/TM2_EXT
31	PB.12/ADC0_CH12/SPI0_MOSI/UART0_RXD/TM3_EXT
32	AVDD

Table 2-1 Pin Assignment for M031TC1AE

2.3 NuTiny-SDK-M031TC PCB Placement

Users can refer to Figure 2-2 for the NuTiny-SDK-M031TC PCB placements.

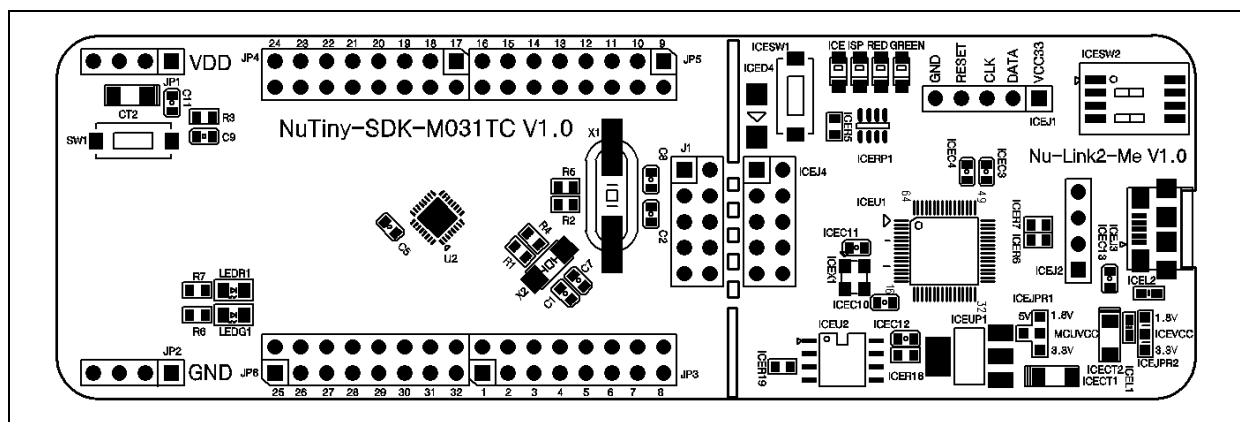


Figure 2-2 NuTiny-SDK-M031TC PCB Placement

3 HOW TO START NUTINY-SDK-M031TC ON THE KEIL MVISION® IDE

3.1 Keil uVision® IDE Software Download and Install

Please visit the Keil company website (<http://www.keil.com>) to download the Keil μ Vision® IDE and install the RVMDK

3.2 Nuvoton Nu-Link Driver Download and Install

Please visit the Nuvoton company NuMicro® website (<http://www.nuvoton.com/NuMicro>) to download “NuMicro® Keil μ Vision® IDE driver” file. When the Nu-Link driver has been well downloaded, please unzip the file and execute the “Nu-Link_Keil_Driver.exe” to install the driver.

3.3 Hardware Setup

The hardware setup is shown as Figure 3-1.

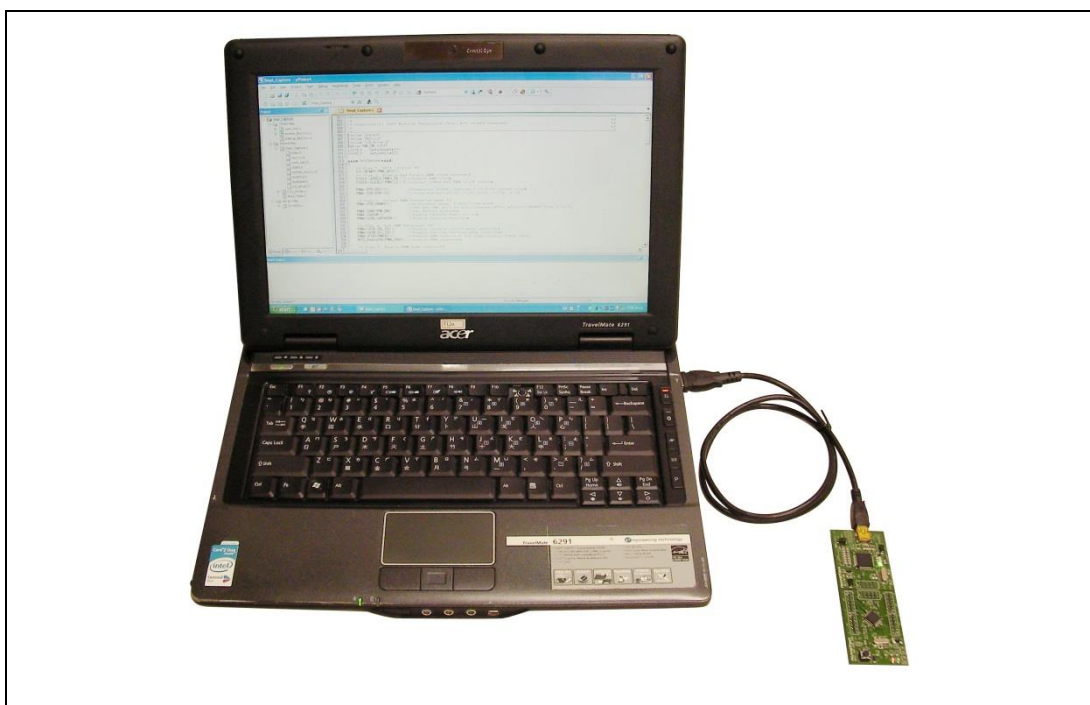


Figure 3-1 NuTiny-SDK-M031TC Hardware Setup

3.4 Example Program

This example demonstrates the ease of downloading and debugging an application on a NuTiny-SDK-M031TC board. It can be found on Figure 3-2 list directory and downloaded from Nuvoton NuMicro® website.

The example file can be found in the directory list shown in Figure 3-2.

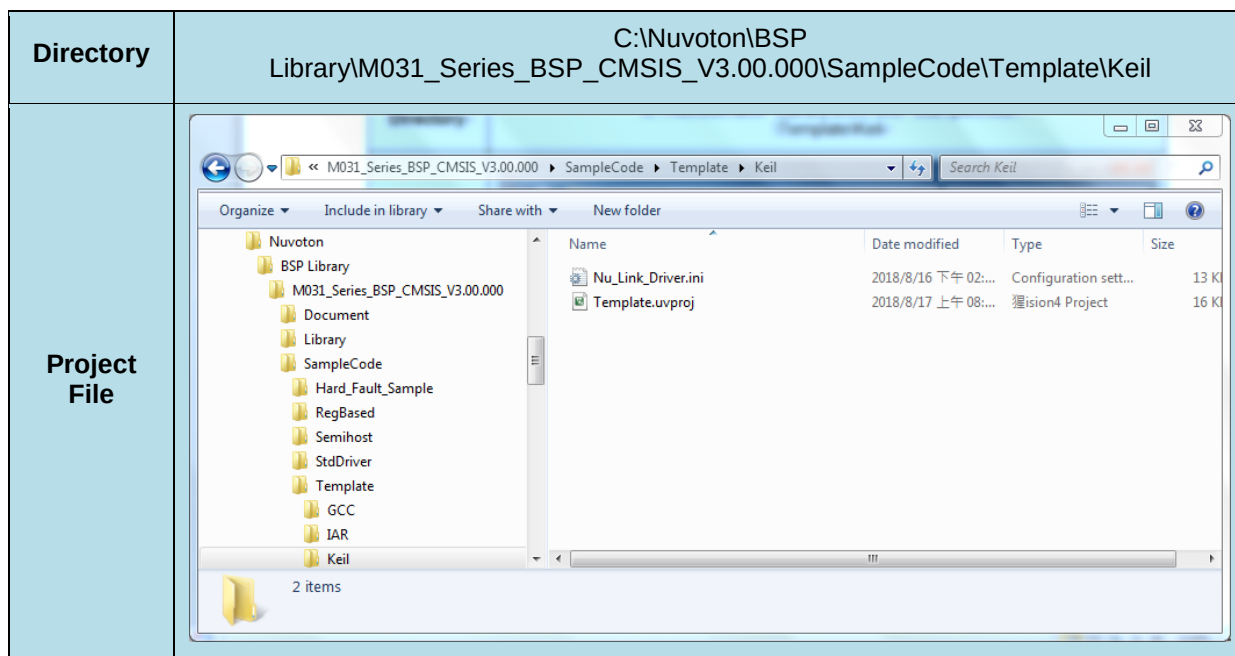


Figure 3-2 Example Directory

This sample code will show some functions about system manager controller and clock controller.

-  Start uVision®
- Project – Open
Open the SYS.uvproj project file
-  Project – Build
Compile and link the SYS application
-  Flash – Download
Program the application code into on-chip Flash ROM
-  Start debug mode
When using the debugger commands, you may:
 - ◆  Review variables in the watch window
 - ◆  Single step through code
 - ◆  Reset the device
 - ◆  Run the application

4 HOW TO START NUTINY -SDK-M031 ON THE IAR EMBEDDED WORKBENCH

4.1 IAR Embedded Workbench Software Download and Install

Please connect to IAR company website (<http://www.iar.com>) to download the IAR Embedded Workbench and install the EWARM.

4.2 Nuvoton Nu-Link Driver Download and Install

Please visit the Nuvoton company NuMicro® website (<http://www.nuvoton.com/NuMicro>) to download the “NuMicro® IAR EWARM Driver” file. When the Nu-Link driver has been well downloaded, please unzip the file and execute the “Nu-Link_Keil_Driver.exe” to install the driver.

4.3 Hardware Setup

The hardware setup is shown as Figure 4-1.

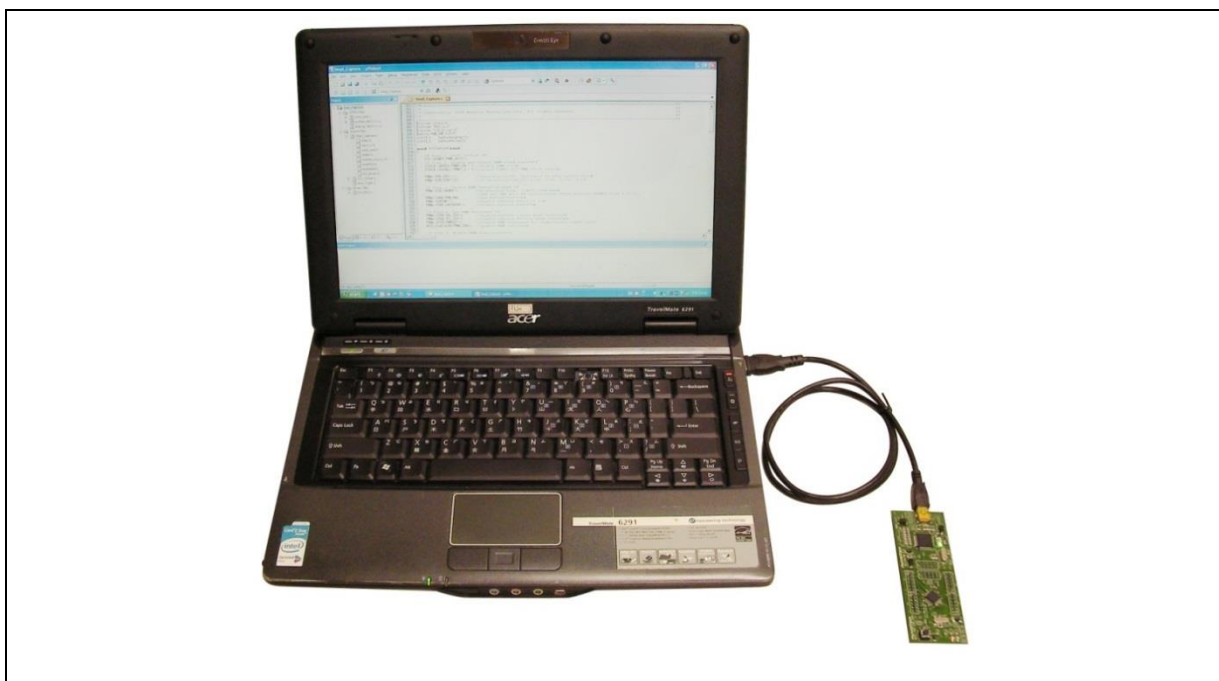


Figure 4-1 NuTiny-SDK-M031TC Hardware Setup

4.4 Example Program

This example demonstrates the ease of downloading and debugging an application on a NuTiny-SDK-M031TC board. It can be found on Figure 4-2 list directory and downloaded from Nuvoton NuMicro® website.

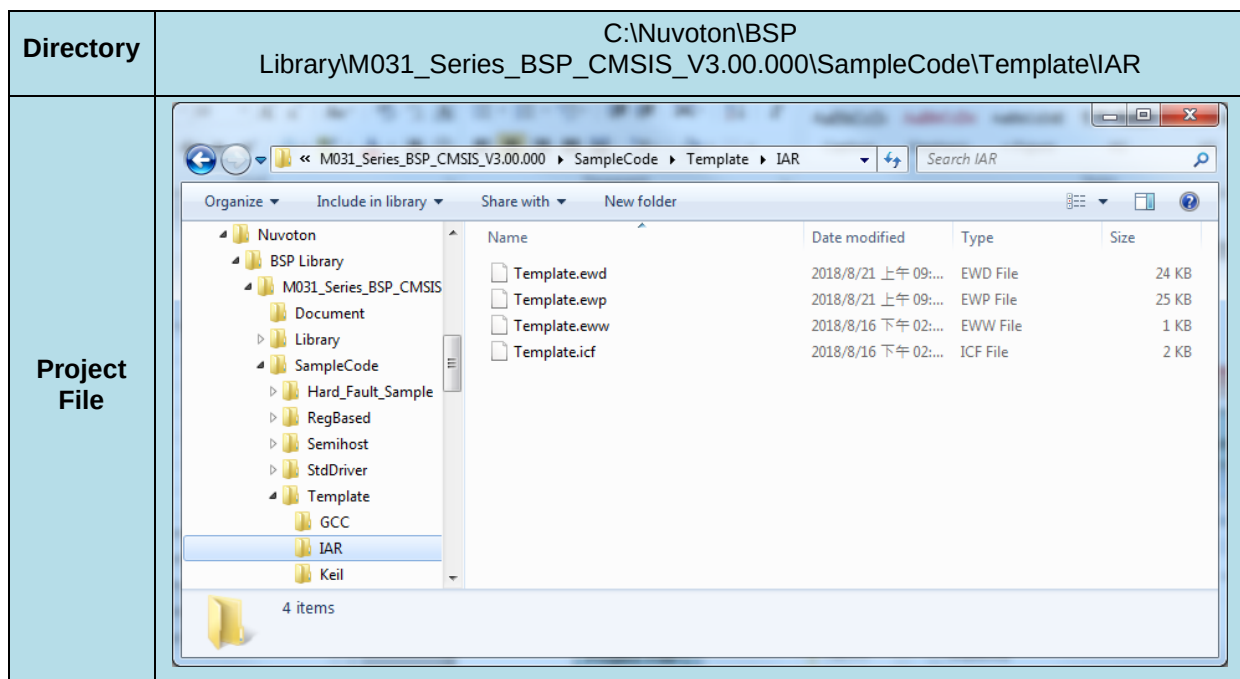


Figure 4-2 Example Directory

This sample code will show some functions about system manager controller and clock controller.

-  Start IAR Embedded Workbench
-  Project – Download and Debug
Program the application code into on-chip Flash ROM
- File-Open-Workspace
Open the SYS.eww workspace file
-  Single step through code
-  Reset the device
-  Project - Make
Compile and link the SYS application
-  Run the application

5 STARTING TO USE NU-LINK2-ME VCOM FUNCTION

5.1 Downloading and Installing VCOM Driver

Please connect to Nuvoton NuMicro® website (<http://www.nuvoton.com/NuMicro>) to download the “NuMicro® ICP Programming Tool” file. After the ICP Programming Tool driver is downloaded, please unzip the file and execute the “ICP Programming Tool.exe”. Simply follow the installation and optional steps to install ICP Programming Tool and Nu-Link USB Driver, which included VCOM driver.

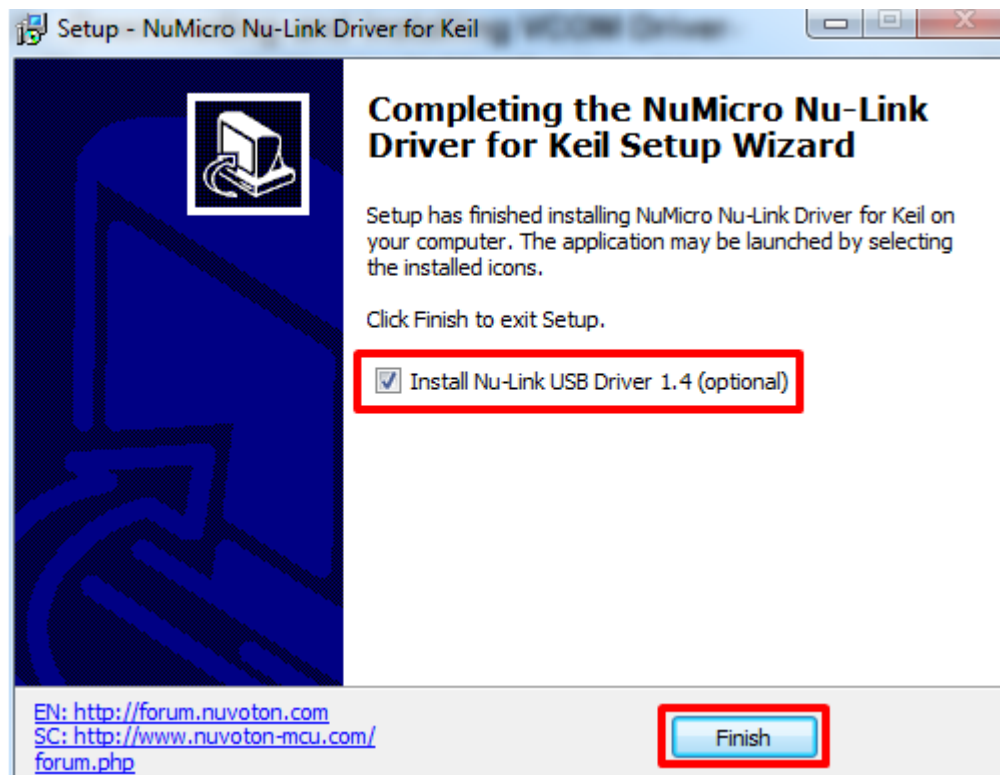


Figure 5-1 Optional Step after ICP Programming Tool Installation

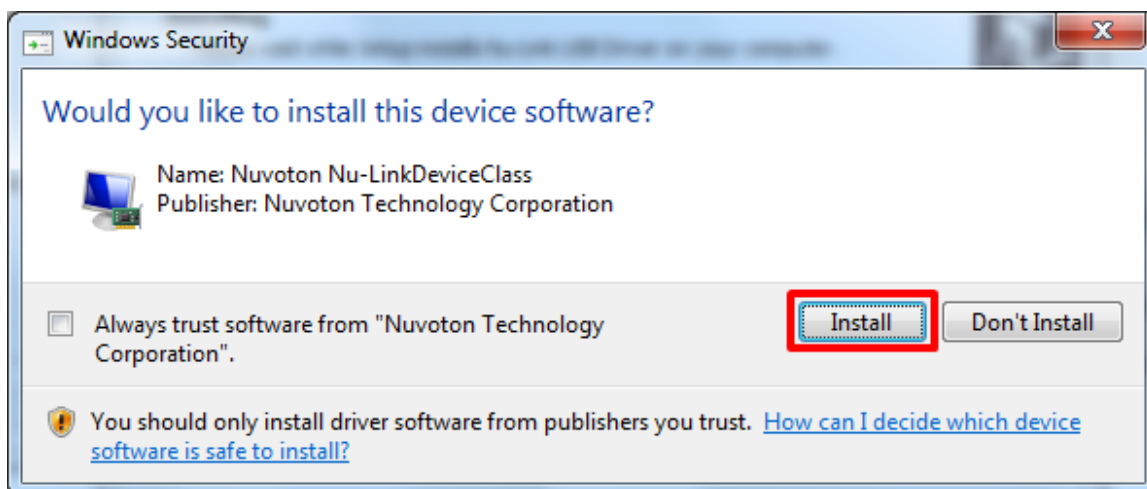


Figure 5-2 Install Nuvoton Nu-LinkDeviceClass

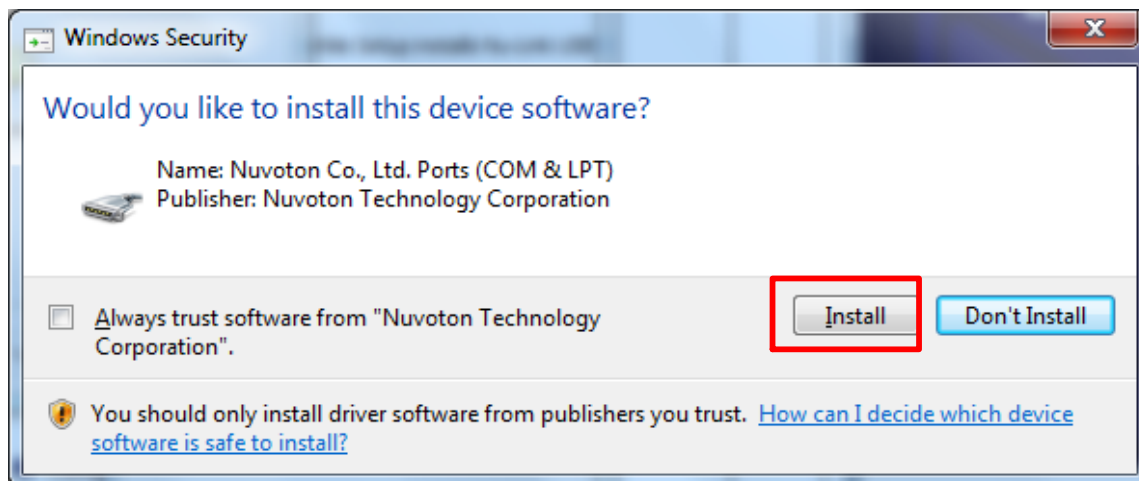


Figure 5-3 Install Nuvoton COM&LPT Driver

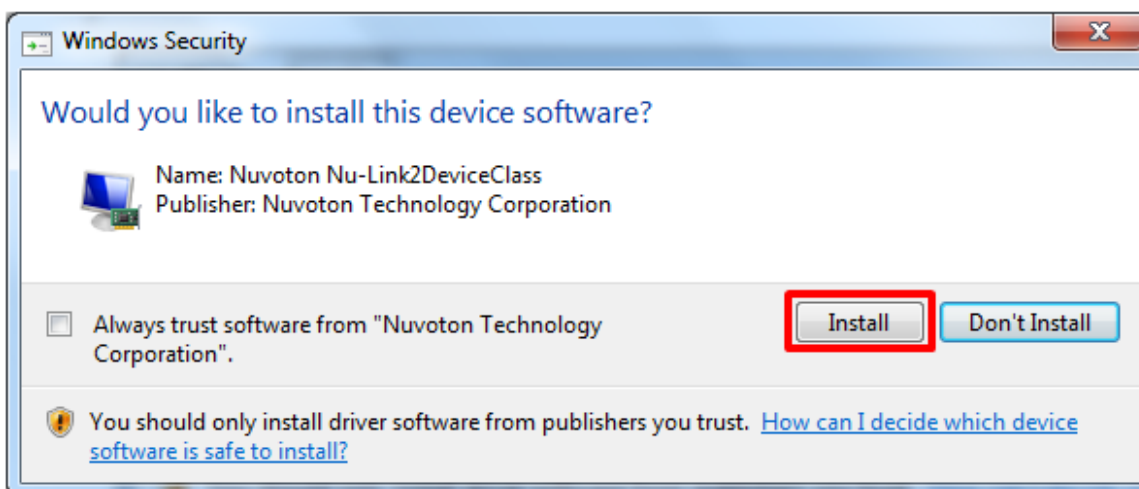


Figure 5-4 Install Nuvoton Nu-Link2DeviceClass

5.2 VCOM Mode Setting on NuTiny-SDK-M031TC

Before the NuTiny-SDK-M031TC is connected to the PC, please enable ICESW2 VCOM function by switching on ICESW2. The NuTiny-SDK-M031TC transmits through UART0 to VCOM to send out data. Switch ICESW2 off when using UART0 function without VCOM function.

5.3 Setup on the Development Tool

The example is demonstrated on the Keil μ Vision[®] IDE.

5.3.1 Check the Using UART on the Keil μ Vision[®] IDE

Please open the project and find system_M031Series.h to check the using UART in DEBUG_PORT, which has to be the same as the using UART in the NuTiny-SDK-M031TC.

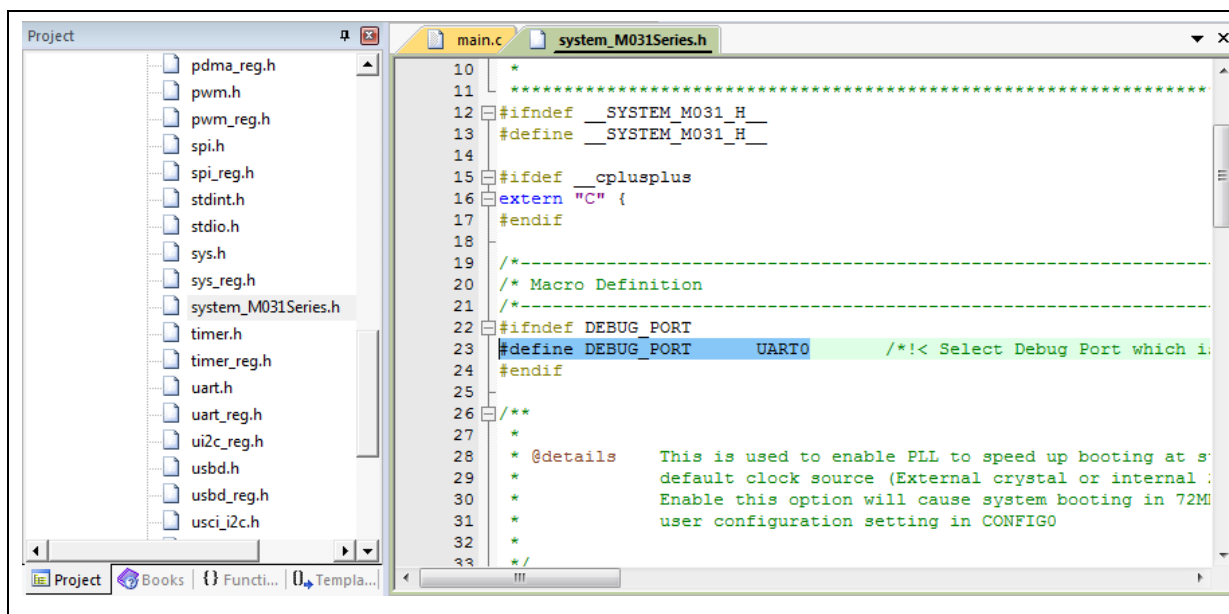
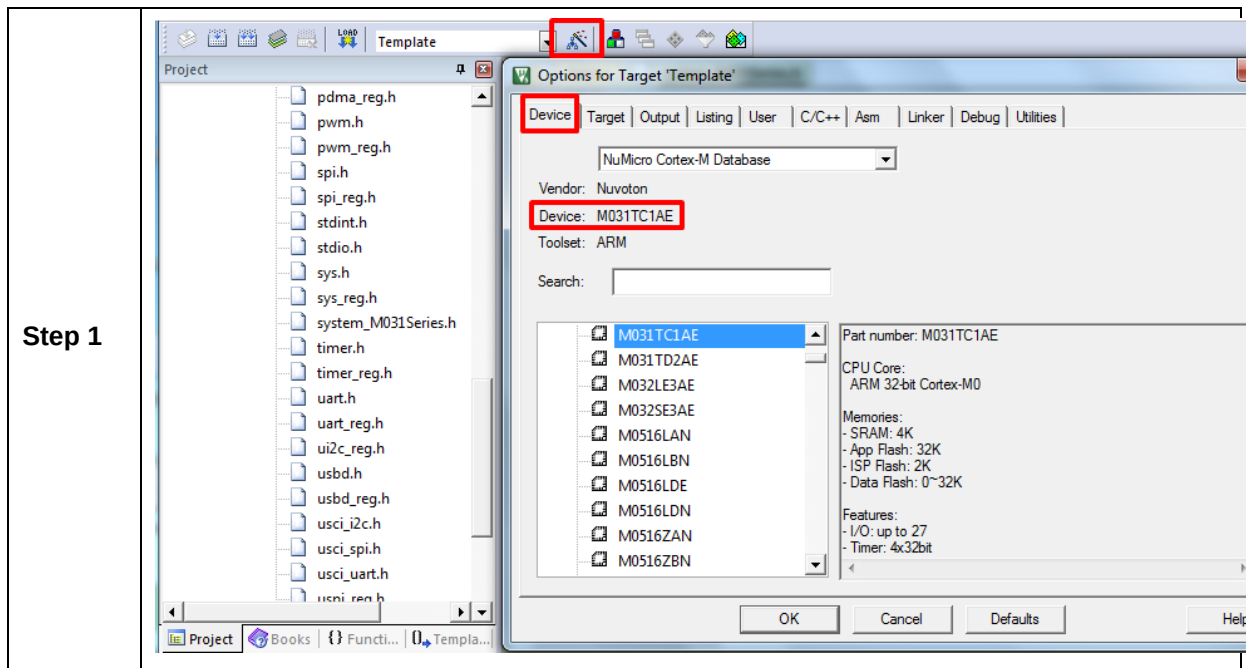


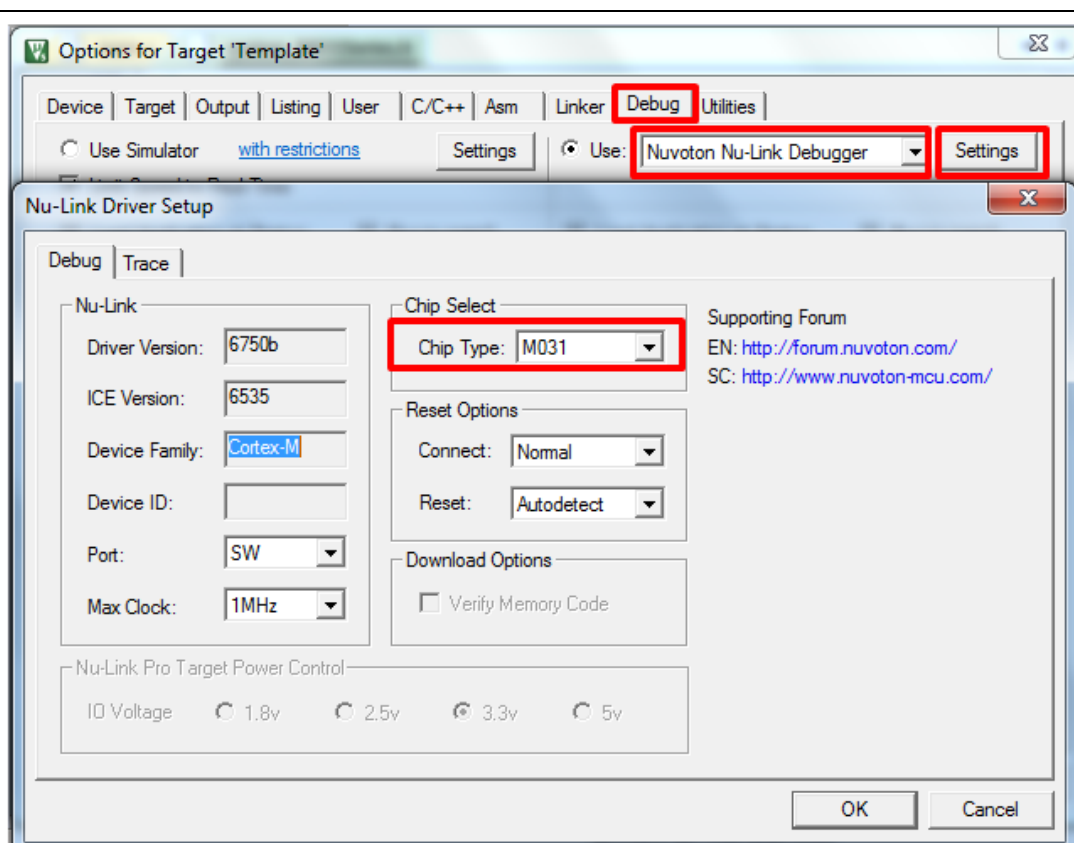
Figure 5-5 The Using UART on Keil μVision® IDE

5.3.2 Check the Target Device and Debug Setting

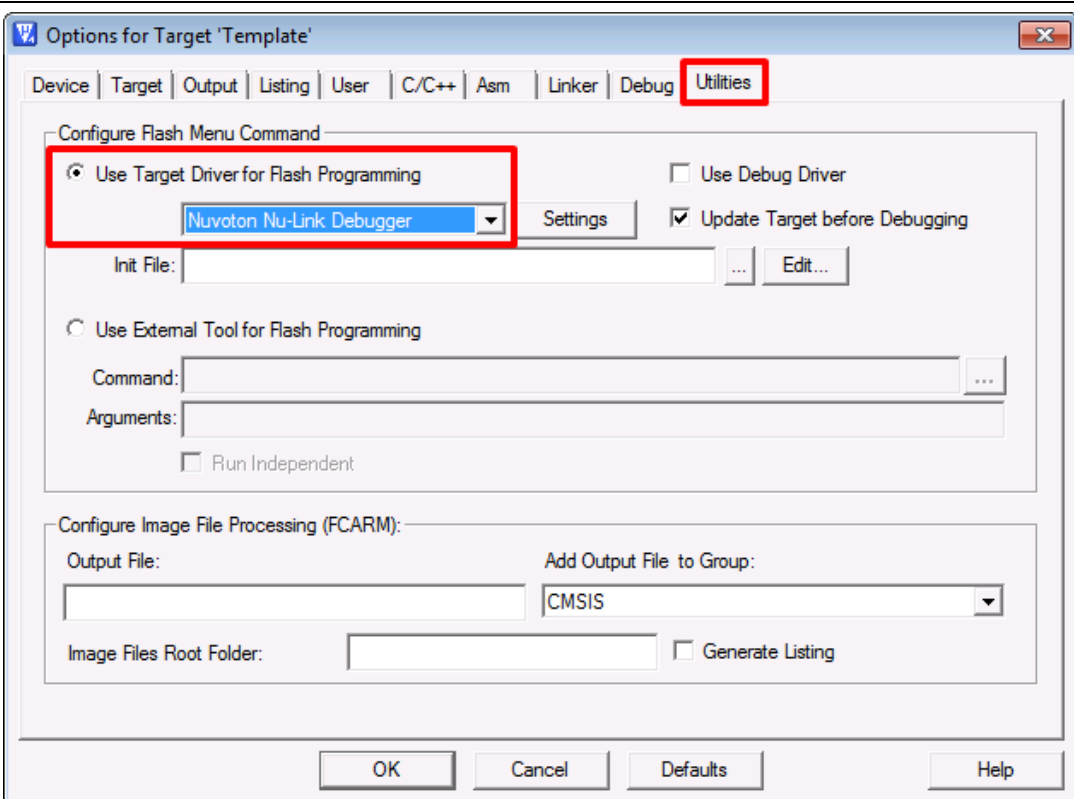
The target device has to be the same as the setting in Debug. Please click “Target Option” to open the Option windows, and find the setting in “Device”, “Debug”, and “Utilities” page. Please follow the steps below to check the setting.



Step 2



Step 3



5.3.3 Build and Download Code to NuTiny-SDK-M031TC

Please build the project and download code to NuTiny-SDK-M031TC.

5.3.4 Open the Serial Port Terminal

User can use serial port terminal, PuTTY for example, to print out debug message.

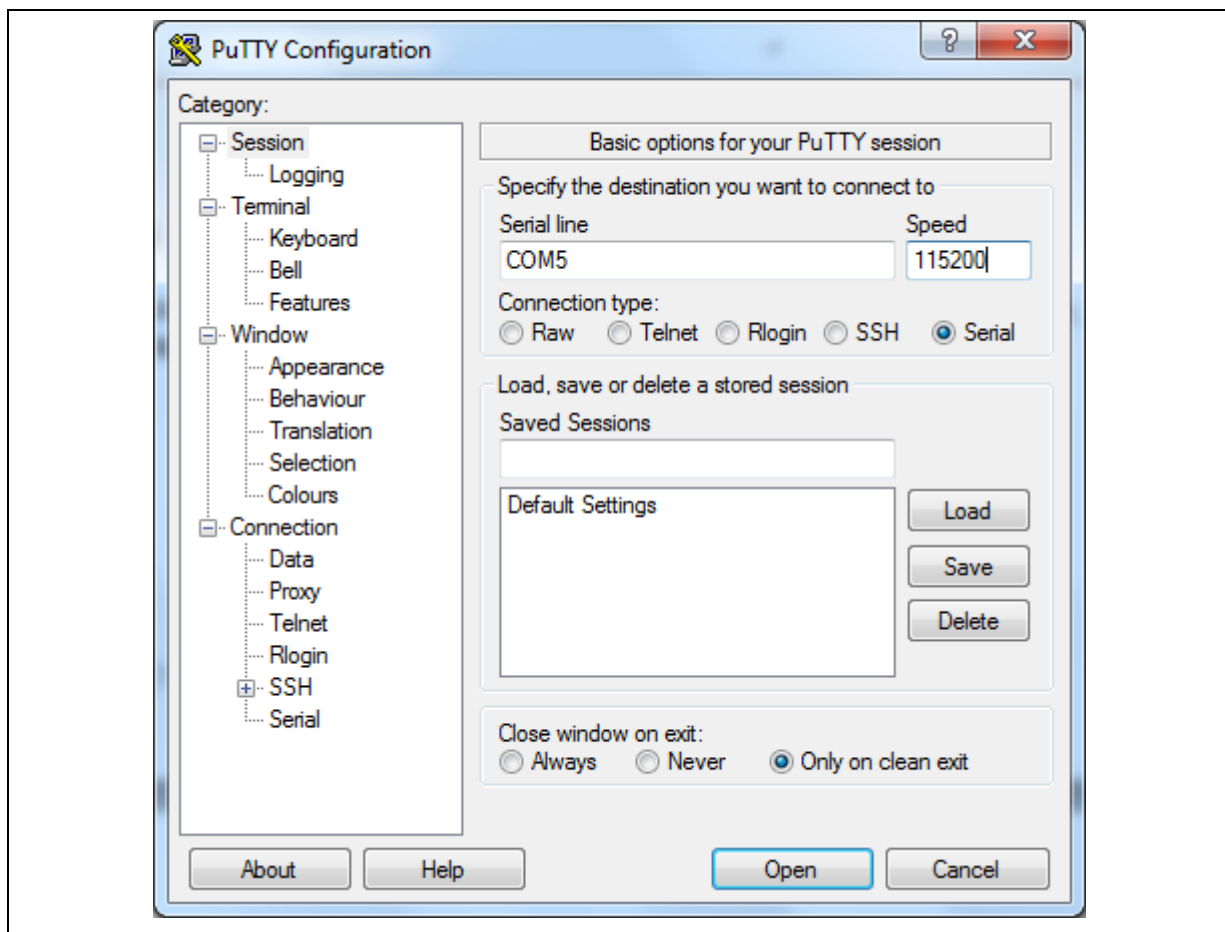


Figure 5-6 Set Baud Rate

5.3.5 Reset Chip

After pushing the reset button and enable ICESW2 VCOM function, the chip will reprogram application and print out debug message.

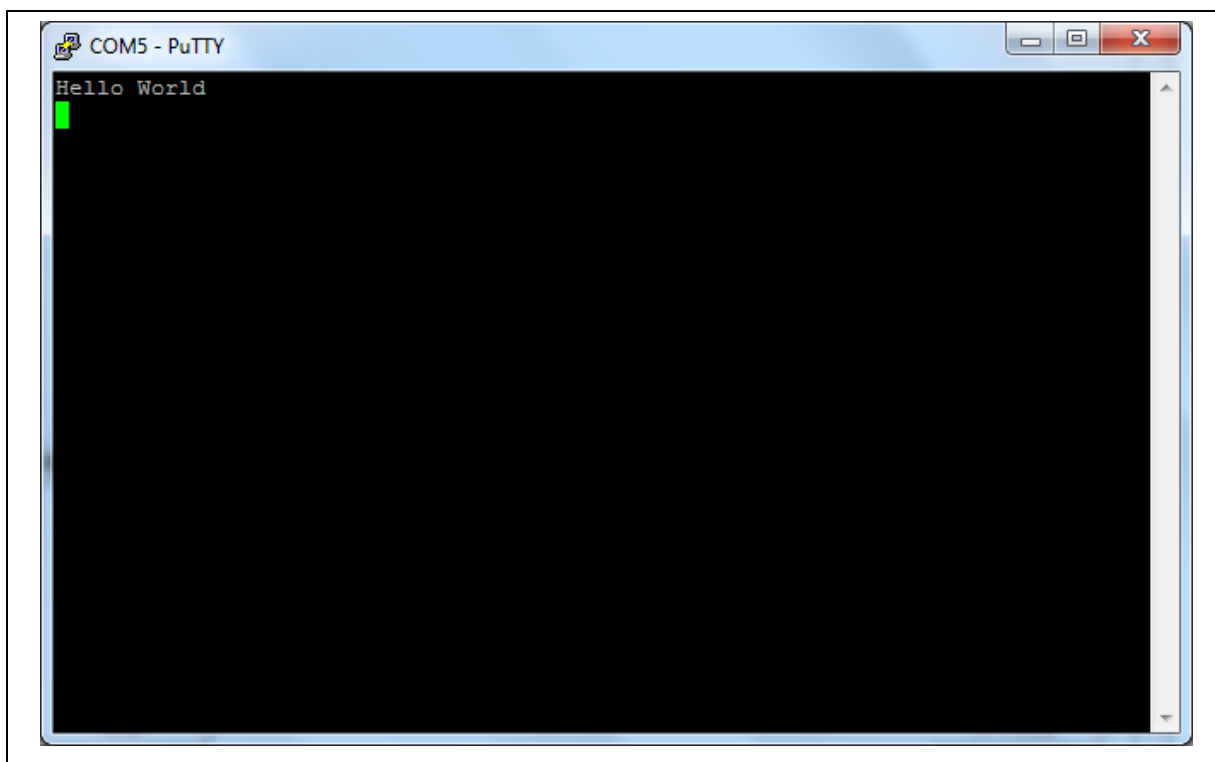
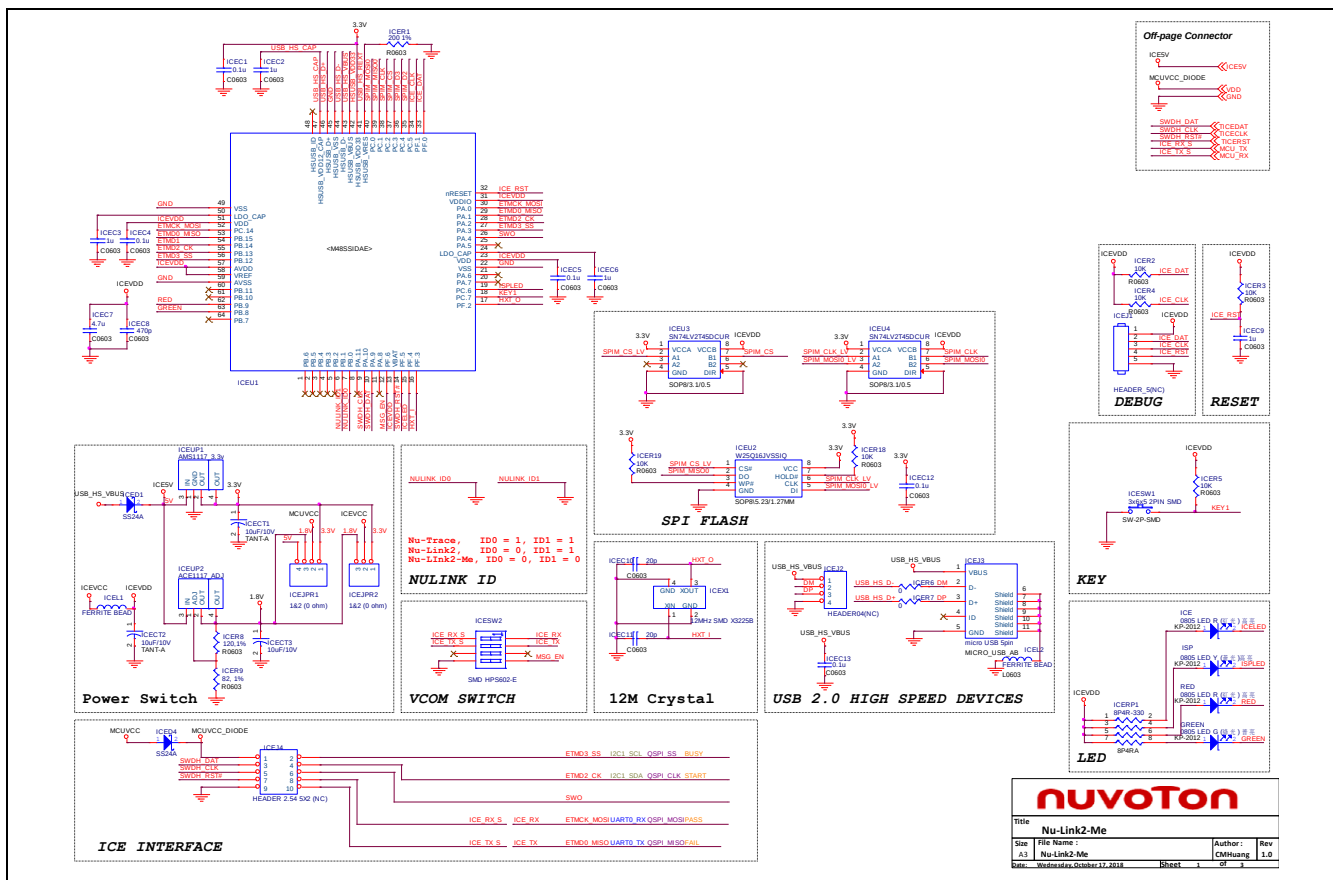


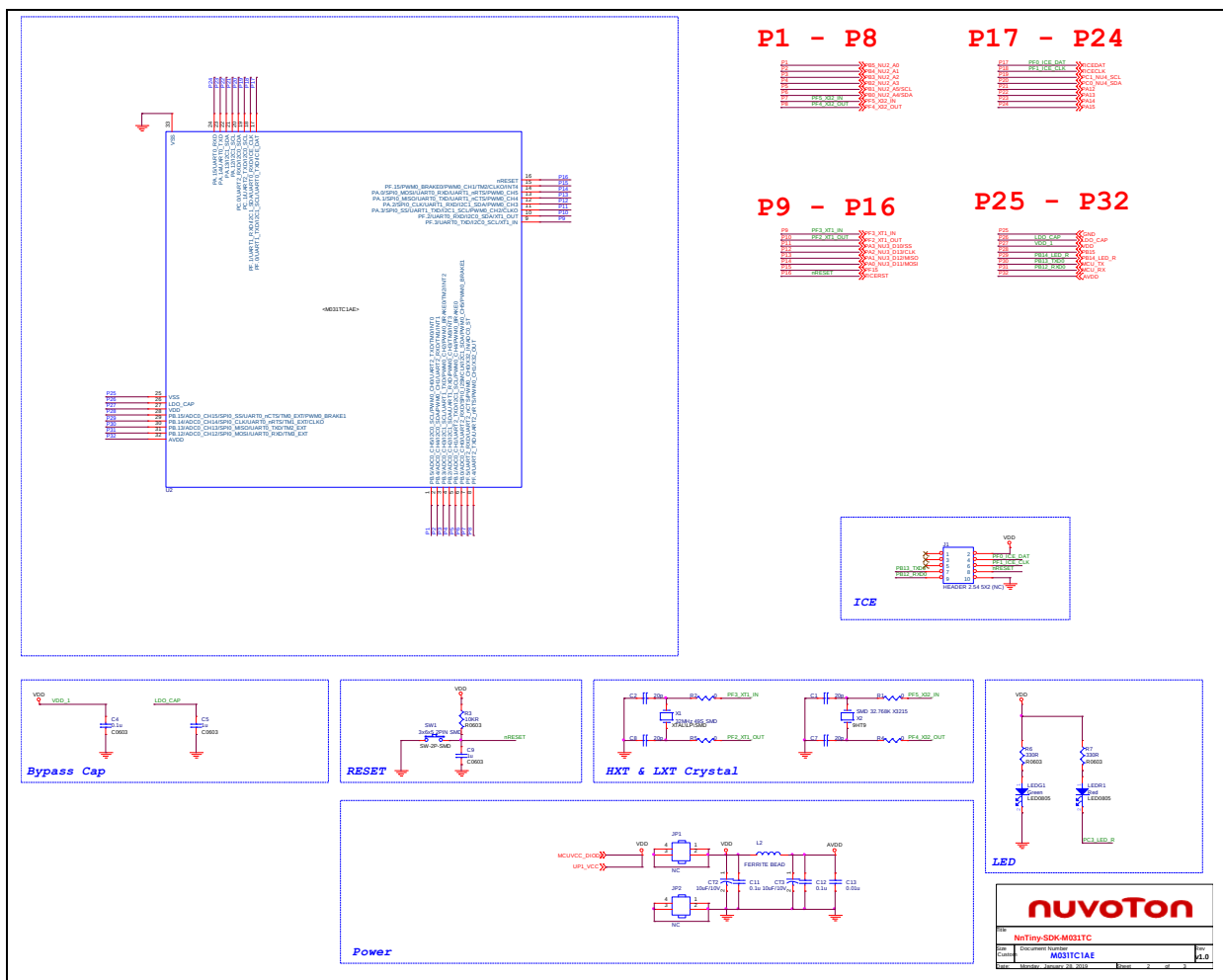
Figure 5-7 Serial Port Terminal Windows

Notice: Please switch ICESW2 on before the NuTiny-SDK-M031TC connects to the PC. When the NuTiny-SDK-M031TC connects to the PC with ICESW2 switch on, PC will detect VCOM as a USB device and the detection will only be processed once.

6.1 Nu-Link2-Me

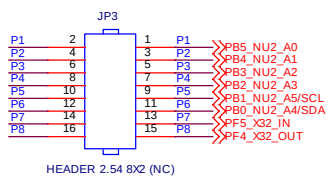


6.2 M031TC1AE

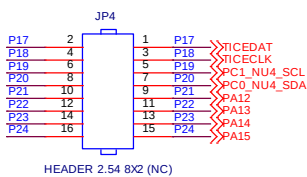


6.3 External Connector

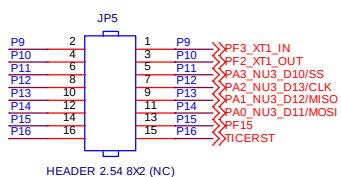
P1 - P8



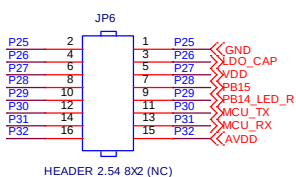
P17 - P24



P9 - P16



P24 - P32



External Connector

nuvoTon		
Title		
NnTiny-SDK-M031TC		
Size	Document Number	Rev
A	Ext. Connector	v1.0
Date: Tuesday, November 27, 2018 Sheet 3 of 3		

7 REVISION HISTORY

Date	Revision	Description
2019.01.28	1.00	1. Initially issued.

Important Notice

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Insecure usage includes, but is not limited to: equipment for surgical implementation, atomic energy control instruments, airplane or spaceship instruments, the control or operation of dynamic, brake or safety systems designed for vehicular use, traffic signal instruments, all types of safety devices, and other applications intended to support or sustain life.

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